DATA SHEET

34420A NanoVolt/Micro-Ohm Meter

RoHS compliant (Serial Number MY61000101 & SG61000101 onwards)



Nanovolt performance at a microvolt price

The Keysight Technologies 34420A nanoVolt/micro-Ohm meter is a high-sensitivity multimeter optimized for performing low-level measurements. It combines low-noise voltage measurements with resistance and temperature functions, setting a new standard in low-level flexibility and performance.

Take the uncertainty out of your low-level measurements

Low-noise input amplifiers and a highly tuned input protection scheme bring reading noise down to 8 nVpp. Combine this with 71/2 digits of resolution, selectable analog and digital filtering, 2 ppm basic 24-hour dcV accuracy, and a shielded, copper pin connector and you've got accurate, repeatable measurements you can count on.

Two input channels

An integral two-channel programmable scanner simplifies voltage comparisons. Built-in ratio and difference functions enable automated two channel measurements without the need for an external nanoVolt scanner. Both channels share the same low noise specifications to ensure accurate comparisons.

Built-in resistance and temperature

The 34420A combines its low-noise nano-Volt input circuits with a high-stability current source to provide precise low-level resistance measurements – no more hassling with the cost and complexity of an external current source. Three resistance modes are included:

- Standard
- Low-power
- Voltage-limited for dry-circuit testing

Offset compensation is also provided to minimize thermal EMFs and associated errors.

Features

- 7½ digit resolution
- 100 pV, 100 nΩ sensitivity
- 1.3 nVrms, 8 nVpp noise performance
- Built-in low noise 2 channel scanner
- Direct SPRT, RTD, Thermistor, and Thermocouple measurements
- BenchVue now inlcuded

KEYSIGHT TECHNOLOGIES

SPRT measurements

Built-in ITS-90 conversion routines accept the calibration coefficients from your SPRT probe for direct temperature measurement and conversion. Thermocouples, thermistors, and RTDs are also supported.

Unequaled versatility

The 34420A gives you the versatility to tackle your most challenging tasks, both on the benchtop and in your automated system. Standard features include RS-232 and GPIB interfaces, SCPI and Keithley 181 programming language, 1024-reading memory, scaling and statistics, and a chart recorder analog output.

Keysight IntuiLink: Easy data access

The included Keysight IntuiLink software allows your captured data to be put to work easily, using PC applications such as Microsoft Excel or Word to analyze, interpret, display, print, and document the data you get from the 34420A. You can specify the meter setup and take a single reading or log data to the Excel spreadsheet in specified time intervals. To find out more about IntuiLink visit www.keysight.com/find/intuilink.

Quality you can count on

The 34420A gives you the quality and reliability you expect from Keysight Technologies. From the Keysight proven > 150,000 hour Mean Time Between Failure, to its standard 1-year warranty, Keysight stands behind you to bring a new level of confidence to your low-level measurements.

BenchVue Software (Now included)



Data capture simplified. Click. Capture. Done.

BenchVue software for the PC makes it simple to connect, control, capture and view Keysight's DMMs simultaneously with other Keysight bench instruments with no additional programming.

- Visualize multiple measurements simultaneously
- Easily log data, screen shots and system state
- Rapidly prototype custom test sequences
- Recall past state of your bench to replicate results
- Export measurement data in desired format fast
- Quickly access manuals, drivers, FAQs and videos
- Monitor and control bench from mobile devices

The Digital Multimeter App within BenchVue enables control of digital multimeters to visualize measurements, perform unrestricted data logging and statistical analysis.

Benefit from a new perspective by visualizing multiple DMM's at the same time

Display single measurements, charts, tables, or histograms from a single instrument or multiple DMMs simultaneously to correlate trends you might otherwise miss.

Record measurements and export results in a few clicks

Log and export data quickly to popular tools such as Microsoft Excel, Microsoft Word and MATLAB for documentation or further analysis.

Access and control tests on your DMM remotely

With the companion BenchVue Mobile app, monitor and respond to long-running tests from anywhere.

Download BenchVue software at no cost today www.keysight.com/find/benchvue

1. One hour limit in no-cost version.



Figure 1. See your measurements across instruments in one place to quickly correlate measurement activities and obtain actionable insights.



Figure 2. BenchVue enables control of your DMM to data log and visualize measurements in a wide array of display options.

Specifications

Accuracy specifications ± (% of reading + % of range) [1]

Function	Range [2]	Test current	24-hour 23 °C ± 1 °C	90 day 23 °C ± 5 °C	1 year 23 °C ± 5 °C	Temperature coefficient 28 °C to 55 °C	Maximum per lead resistance
dc voltage	1.0000000 mV [3]		0.0025 + .0020	0.0040 + .0020	0.0050 + .0020	0.0004 + .0001	
	10.000000 mV [3]		0.0025 + .0020	0.0040 + .0002	0.0050 + .0003	0.0004 + .0001	
	100.00000 mV		0.0015 + .0003	0.0030 + .0004	0.0040 + .0004	0.0004 + .00006	
	1.0000000 V		0.0010 + .0003	0.0025 + .0004	0.0035 + .0004	0.0004 + .00004	
	10.000000 V		0.0002 + .0001	0.0020 + .0004	0.0030 + .0004	0.0001 + .00002	
	100.00000 V [4]		0.0010 + .0004	0.0025 + .0005	0.0035 + .0005	0.0004 + .00005	
Resistance [5]	1.0000000 Ω	10 mA	0.0015 + .0002	0.0050 + .0002	0.0070 + .0002	0.0005 + .00002	1 Ω
	10.000000 Ω	10 mA	0.0015 + .0002	0.0040 + .0002	0.0060 + .0002	0.0005 + .00001	1 Ω
	100.00000 Ω	10 mA	0.0015 + .0002	0.0040 + .0002	0.0060 + .0002	0.0005 + .00001	10 Ω
	1.0000000 KΩ	1 mA	0.0015 + .0002	0.0040 + .0002	0.0060 + .0002	0.0005 + .00001	100 Ω
	10.000000 KΩ	100 µA	0.0015 + .0002	0.0040 + .0002	0.0060 + .0002	0.0005 + .00001	1 KΩ
	1.0000000 MΩ	10 µA	0.0015 + .0003	0.0040 + .0004	0.0060 + .0004	0.0005 + .00002	1 KΩ
	100.00000 KΩ	5 µA	0.0020 + .0003	0.0050 + .0004	0.0070 + .0004	0.0006 + .00003	1 KΩ
Low power resistance [5]	1.0000000 Ω	10 mA	0.0015 + .0002	0.0050 + .0002	0.0070 + .0002	0.0005 + .00002	1 Ω
	10.000000 Ω	10 mA	0.0015 + .0002	0.0040 + .0002	0.0060 + .0002	0.0005 + .00001	1 Ω
	100.00000 Ω	1 mA	0.0015 + .0002	0.0040 + .0002	0.0060 + .0002	0.0005 + .00001	10 Ω
	1.0000000 KΩ	100 µA	0.0015 + .0002	0.0040 + .0002	0.0060 + .0002	0.0005 + .00001	100 Ω
	10.000000 KΩ	10 µA	0.0015 + .0004	0.0040 + .0004	0.0060 + .0004	0.0005 + .00001	1 KΩ
	1.0000000 MΩ	5 µA	0.0015 + .0012	0.0040 + .0015	0.0060 + .0015	0.0005 + .00003	1 KΩ
	100.00000 KΩ	5 µA	0.0020 + .0003	0.0050 + .0004	0.0070 + .0004	0.0006 + .00003	1 KΩ
Voltage limited resistance [5, 6]	10.000000 Ω	1 mA	0.0020 + .0002	0.0050 + .0002	0.0070 + .0002	0.0005 + .00002	1 Ω
	100.00000 Ω	100 µA	0.0025 + .0002	0.0050 + .0002	0.0070 + .0002	0.0005 + .00002	5 Ω
Channel 1 / Channel 2 (dcV Ratio)	Ratio error in % = Channel 1 accuracy in % + Channel 2 accuracy in %						
Channel 1 - Channel 2 (dcV difference)	Difference error = Channel 1 (% of reading + % of range) + Channel 2 (% of reading + % of range)						
Temperature	Resolution = 0.001 °C						
SPRT [7]	SPRT probe accuracy + 0.003 °C						
RTD	RTD probe accuracy + 0.05°C						
Thermistor	Thermistor probe accuracy + 0.1 °C						
Thermocouple [8]	Thermocouple probe accuracy + 0.2 °C						

1. Specifications are for Channel 1 or Channel 2, after 2-hour warm-up, resolution at 7.5 digits (100 NPLC), with FILTERS off. RESISTANCE specifications are for 4-wire Ohms or 2-wire ohms using Null. Without Null, add 0.2 Ohms additional error in 2-wire Ohms function. For Analog Filter ON, add 0.002% of reading.
2. 20% overrange on all ranges except 5% on Voltage Limited Resistance.
3. After using Math Null. If Null is not used add 100 nanoVolts.
4. Channel 1 only.
5. Channel 1 only. Resistance measurements, for NPLC < 1, add 160 µΩ rms noise.
6. Voltage limit can be set to 20 mV (default), 100 mV, or 500 mV. Measured resistance plus Channel 1 HI and LO lead resistance is limited to 10.5 Ω on the 10 Ω range and 105 Ω on the 100 Ω range.
7. For 25 Ω SPRT with triple-point of water check within the last 4 hours. Without the triple-point of water check, add 0.013 °C for 24 hours, add 0.035 °C for 90 day, and add 0.055 °C for 1 year specifications.
8. For fixed reference junction. Add 0.3 °C for external reference junction, add 2.0 ûC for internal reference junction.

Specifications (continued)

DC voltage noise [1]

Observational period			
Range	2-minute RMS noise	2-minute peak-peak noise	24-hour peak-peak noise
1 mV	1.3 nVrms	8 nVpp	12 nVpp
10 mV	1.5 nVrms	10 nVpp	14 nVpp
100 mV	10 nVrms	65 nVpp	80 nVpp
1 V	100 nVrms	650 nVpp	800 nVpp
10 V	450 nVrms	3 µVpp	3.7 µVpp
100 V	11 µVrms	75 µVpp	90 µVpp

DC voltage noise vs source resistance [2]

Source resistance	Noise	Analog filter	Digital filter
0 Ω	1.3 nVrms	Off	Med
1000 Ω	1.7 nVrms	Off	Med
1 kΩ	4 nVrms	Off	Med
10 kΩ	13 nVrms	Off	Med
100 kΩ	41 nVrms	Off	Med
1 MΩ	90 nVrms	Off	Med

1. After a 2-hour warm-up, ± 1 °C, 6.5 digits (10 PLC) with Analog Filter Off and Digital Filter Medium (50 reading average). 2-minute rms and 24-hour noise typical. For measurements using 0.02 or 0.2 NPLC, add 800 nV rms noise.
2. Typical noise behavior for Ch 1 or Ch 2, after 2 hour warm-up, 6.5 digits (10 PLC), 2 minute observation period on 1 mV range. For peak-to-peak noise, multiply rms noise by 6.

Measurement Characteristics

DC voltage	
Measurement method	Continuously integrating multi-slope III
	A-D Converter
A-D linearity	0.00008% of reading + 0.00005% of range
Input resistance	100 V (Ch1 only): 10 MΩ ± 1%
	1 mV through 10 V: > 10 GΩ, in parallel with < 3.6 nF
Input bias current	< 50 pA at 25 °C
Injected current	< 50 nA pp at 50 or 60 Hz
Input protection	150 V peak any input terminal to Channel 1 LO, continuous
	Channel-to-channel switching error (typical): 3 nV
Channel isolation	Isolation between input channels > 10^{10} Ω
Earth isolation	350 V peak any input terminal to earth
	Impedance from any input terminal to earth is > 10 GΩ and < 400 pF
Maximum voltage	Channel 1 LO to Channel 2 LO, 150 V peak
Resistance	
Measurement method	Selectable 4-wire or 2-wire ohms
	Current source referenced to Channel 1 LO input
Offset compensation	Used on all ranges except 100 kΩ and 1 MΩ
	Can be turned off if desired
Protection	150 V peak
Open circuit voltage	For resistance and low power resistance
	< 14 V. 20 mV, 100 mV, 500 mV selectable clamp
Temperature	
SPRT	ITS-90 calibrated temperature with the range of –190 °C to +660 °C
Thermocouple	ITS-90 conversions of Type B, E, J, K, N, R, S, T
Thermistor	5 kΩ
RTD	Type α =.00385 and α =.00392. R0 from 4.9 Ω to 2.1 kΩ. ITS -90 (IEC-751) Callendar Van Dusen conversion.
Measurement noise rejection 60 (50) Hz [1]	
dc CMRR	140 dB
ac CMRR	70 dB

1. For 1 kΩ unbalanced in LO lead.

Operating Characteristics [1]

Function	Digits	Integration time	Readings/s [2]
dcV thermocouple	7-1/2	200 plc	.15 (.125)
	7-1/2	100 plc	.3 (.25)
	6-1/2	20 plc	.1.5 (1.25)
	6-1/2	10 plc	3 (2.5)
	5-1/2	1 plc	25 (20.8)
	5-1/2	0.2 plc	100 (100)
	4-1/2	0.02 plc	250 (250)
Resistance	7-1/2	200 plc	.075 (.062)
dcV1/DCV2	7-1/2	100 plc	.15 (.125)
dcV 1-2	6-1/2	20 plc	.75 (.625)
RTD	6-1/2	10 plc	1.5 (1.25)
Thermistor	5-1/2	1 plc	12.5 (10.4)
0.2 plc	50 (50)		
	4-1/2		
0.02 plc	125 (125)		

1. Speeds are for delay 0, Display OFF, Filters OFF, Offset Compensation OFF.
2. Reading speeds for 60 Hz or (50 Hz), 100 mV through 100 V ranges. 1 mV range 30/s MAX, 10 mV range 170/s MAX, thermocouple 120/s MAX.

Operating Characteristics [1] (Continued)

Integration time	Normal mode rejection [2]
200 plc/3.335 s (4 s)	110 dB [3]
100 plc/1.675 s (2 s)	105 dB [3]
20 plc/334 ms (400 ms)	100 dB [3]
10 plc/167 ms (200 ms)	95 dB [3]
2 plc/33.3 ms (40 ms)	90 dB
1 plc/16.7 ms (20 ms)	60 dB
< 1 plc	0
System speeds [4]	
Configuration rates	26/s to 50/s
Autorange rate (Volts)	> 30/s
ASCII reading to RS-232	55/s
ASCII reading to GPIB	250/s
Max. internal trigger rate	250/s
Max. ext. trig. rate to memory	250/s
Triggering and memory	
Reading HOLD sensitivity	10%, 1%, 0.1%, or 0.01% of range
Samples/Trigger	1 to 50,000
Trigger delay	0 to 3600 s; 10 µs step size
External trigger delay	< 1 ms
External trigger jitter	< 500 µs
Memory	1024 readings
Math functions	
NULL	Channel 1 dcV, Channel 2 dcV, Difference, Resistance, Temperature
STATS	Min, Max, Average, Peak-Peak, Standard Deviation, Number of readings
SCALE	Allows linear scaling as y = mx+b
CHART NULL	Establishes zero for rear panel output
Filter (Analog or digital or both)	
Analog	Low pass 2 pole at 13 Hz, available for dcV on 1 mV, 10 mV, 100 mV range
Digital	Moving average filter, 10 (fast), 50 (medium), or 100 (slow) reading averages
Chart Out (Analog out)	
Maximum output	± 3V
Resolution	16 bits
Accuracy	± 0.1% of output + 1 mV
Output resistance	1 kΩ ± 5%
Update rate	Once per reading
Span and offset	Adjustable
Standard programming languages	
SCPI (IEEE 488.2), Keithley 181	
Accessories included	
4 ft low thermal cable with copper spade lugs, Kelvin clip set, 4-wire shorting plug, user's manual, service manual, test report, contact cleaner, and power cord.	

1. For 1 kΩ unbalanced in LO lead.
2. For power line frequency ± - 0.1%, Filters OFF. For Digital Filter slow add 20 db, for medium or fast add 10 db for NPLC [3] 1.
3. For power line frequency ± - 1%, use 80 db, for ± 3% use 60 db.
4. Speeds are for NPLC 0.02, Delay 0, Display OFF, Chart Out OFF.

General Specifications

Options	Description
Front panel connection	Shielded, low thermal, 99% copper contacts
Power supply	100 V/120 V/220 V (230 V)/240 V ± 10%
Power line frequency	45 Hz to 66 Hz and 360 Hz to 440 Hz
	Automatically sensed at power-on
Power consumption	25 VA peak (10 W average)
Operating environment	Full accuracy for 0 °C to 55 °C
	Full accuracy to 80% RH at 40 °C (non condensing)
	Full accuracy to 40% RH for 41 °C to 55 °C (non-condensing)
Storage environment	–40 °C to 75 °C
Size	254.4 mm W x 374.0 mm L x 103.6 mm H (10.02” W x 14.72” L x 4.08” H)
Weight	3 kg (6.5 lbs)
Safety	Designed to CSA, UL-1244, IEC-1010. RFI and ESD: CISPR 11.

Ordering Information

Includes low thermal input cable (34102A), low thermal shorting plug (34103A), Kelvin clip set (11062A), calibration certificate, power cord. Also includes CD with: IntuiLink software, IVI and VXI PnP drivers, user’s guide, service guide, and data sheet.

Options	Description
34420A-ABA	English localization
34420A-ABD	German localization: Translated operating manual
34420A-ABF	French localization: Translated operating manual
34420A-ABJ	Japanese localization: Translated operating manual
34420A-A6J	ANSI Z540 compliant calibration

Accessories

Options	Description
34102A	Low-thermal input cable (four conductor) with copper spade lugs
34103A	Low-thermal shorting plug
34104A	Low-thermal input connector
34131A	Transit case
34161A	Accessory pouch
34190A	Rackmount Kit: Designed for use with only one instrument, mounted on either the left or the right side of the rack.
34191A	2U Dual Flange Kit: Secures the instrument to the front of the rack. This kit can be used with the instrument to the front of the rack.
34194A	Dual Lock Link Kit: Recommended for side-by-side combinations and includes links for instruments of different depths. This kit can be used with the 34191A 2U Dual Flange Kit to mount two half-width, 2U height instruments side-by-side.

Learn more at: www.keysight.com

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